4. Alternatives Analysis

4.1 Introduction and Overview

One of the requirements in the preparation of an EIR is the identification and assessment of reasonable alternatives that have the potential for avoiding or substantially minimizing one or more significant impacts of a proposed project while meeting most of the project's objectives. In addition to mandating consideration of the No Project Alternative, the State California Environmental Quality Act (CEQA) Guidelines (Section 15126.6(d)) emphasize the selection of a reasonable range of feasible alternatives and adequate assessment of these alternatives to provide a comparative analysis for consideration by decision makers. An alternative cannot be eliminated simply because it is more costly or could impede the attainment of project objectives to some degree. However, the State CEQA Guidelines describe that an EIR need not consider an alternative whose effects cannot be reasonably ascertained or whose implementation is remote or speculative.

CEQA does not require that the discussion of alternatives be at the same level of detail as the proposed project. However, CEQA does require that an EIR include sufficient information about each alternative to allow for meaningful evaluation and comparison with the proposed project.

This analysis does not address the social or economic consequences of implementing any of the alternatives because State CEQA Guidelines Section 15131 states, "Economic or social effects of a project shall not be treated as significant effects on the environment." Accordingly, the alternatives analysis and the other analyses in this EIR do not focus on such factors.

The CDWR considered several alternatives before selecting the proposed project. Potential alternatives eliminated from further consideration are discussed in Section 4.2 and include Buttes Reservoir, Fairmont Reservoir, Mile 309 Offstream Storage, Multiple Reservoirs, Tehachapi Afterbay Enlargement (three configurations), Quail Lake, and Tehachapi East Afterbay (TEA) Over Land. Those alternatives considered to be reasonable CEQA alternatives to the proposed project are discussed in Section 4.3 and include Tehachapi Second Afterbay (T2A), TEA Jacking/Tunneling, TEA Trenching, TEA Overchute, Enlarged Afterbay, and the No Project Alternative. A discussion and determination of the environmentally superior alternative is provided in Section 4.4, along with a summary table comparing the reasonable alternatives to the proposed project.

4.2 Potential Alternatives Eliminated from Further Consideration

As described in Section 2.2, the California Department of Water Resources' basic objective for the proposed project is to shift the pumping load of the Valley String Pumping Plants from peak (high demand) periods to off-peak (low demand) periods, thereby providing the State Water Project with increased operational flexibility and system reliability, and the statewide benefits of more efficient and stable energy consumption. The primary objectives of the proposed project, as defined by the CDWR, are summarized as follows:

- Provide additional operational storage for the Valley String Pumping Plants
- Provide State Water Project operators additional operational flexibility for the Valley String Pumping Plants, while avoiding increased operational complexity

- Reduce expensive pumping at the Valley String Pumping Plants during on-peak periods.

Early in the development of the proposed project, the CDWR prepared the *Valley String Peaking Storage Study: A Pre-feasibility Evaluation of Storage Alternatives for the San Joaquin Valley Pumping Plants* (CDWR 2004a), which examined options for meeting the project objectives. Methods for meeting these objectives included the enlargement of existing facilities, re-operation of existing facilities, and/or construction of new facilities. The following potential alternatives were evaluated by the CDWR as part of the Valley String Peaking Storage Study: Buttes Reservoir, Fairmont Reservoir, Mile 309 Offstream Storage, Multiple Reservoirs, Quail Lake (re-operation), and Tehachapi Afterbay Enlargement (three configurations).

Potential alternatives were evaluated for engineering or environmental fatal flaws. Fatal flaws are defined as a failure to meet fundamental project design criteria or any issue related to design, construction, or operation that cannot be reasonably or cost-effectively mitigated. As fatal flaws were identified for a given potential alternative, further analysis was stopped. Environmental fatal flaw studies (CDWR 2004a) were performed on proposed projects that withstood technical fatal flaw evaluation and were evaluated in a subsequent screening phase. Engineering and environmental fatal flaws considered included:

- Enlargement of the East Branch of the Aqueduct;
- Seismic stability;
- Oversized to achieve same project objectives;
- Impacts to biologically and/or archeologically sensitive areas; and
- Water quality, hydrologic, and operational issues.

From this fatal flaw screening process, the following potential alternatives were eliminated from further consideration: Buttes Reservoir, Fairmont Reservoir, Mile 309 Offstream Storage, Multiple Reservoirs, and Tehachapi Afterbay Enlargement (two configurations). These potential alternatives and the reasons for elimination are described below.

Fatal Flaw Screening

Buttes Reservoir

Antelope Valley – East Kern Water Agency (AVEK) proposed the Buttes Reservoir project to store water from the California Aqueduct and deliver it to AVEK's distribution system. The reservoir was proposed to be located immediately south of Highway 138 about 15 miles west of Lancaster, approximately 1.5 miles northeast of Check 46 on the East Branch and 17.5 miles downstream of the existing Tehachapi Afterbay, at the edge of the California Poppy Preserve (see Figure 4-1).

Two configurations for the reservoir were considered initially. For both, a main, roller-compacted concrete dam would be located on the north end, the Fairmont Buttes on the west, the Antelope Buttes on the east and south, and an earth fill closure dike on the southwest, forming Buttes Reservoir. Two small saddle dams would also be required, as well as the enlargement of the East Branch of the Aqueduct. Because this potential alternative required enlargement of the East Branch, which was a criteria for exclusion of an alternative, the Buttes Reservoir was eliminated from further consideration. In addition, the Buttes Reservoir may have serious environmental consequences, as the site encompasses the California Poppy Reserve.

Tehachapi East Afterbay Project

Figure 4-1

Locations of Potential Alternatives

To Bakersfield
99
166
5
Teerink Pumping Plant
Chrisman Pumping Plant
Edmonston Pumping Plant
Tehachapi Mountains
Porter Tunnel
Tehachapi Afterbay
Oso Pumping Plant
Alamo Powerplant
Kern County
Ventura County
5
Quail Lake
138
To Lancaster
Peace Valley Pipeline
William E. Warne Powerplant
Pyramid Lake
Los Angeles County
Ventura County
Angeles Tunnel
Castaic Powerplant (LADWP)
5
Castaic Lake
To Los Angeles
To Lake Perris

ENLARGED AFTERBAY
TEA ALTERNATIVES
MULTIPLE RESERVOIRS
MILE 309 OFFSTREAM STORAGE
TEHACHAPI SECOND AFTERBAY
QUAIL LAKE
BUTTES RESERVOIR
TEHACHAPI AFTERBAY ENLARGEMENT (THREE CONFIGURATIONS)
FAIRMONT RESERVOIR

N

0 4 8 16
Scale in Miles

Fairmont Reservoir

Completed in 1913, the Fairmont Reservoir No. 1 was part of the original Los Angeles Aqueduct, which crosses the California Aqueduct at Pool 44. When operational, the Los Angeles Department of Water and Power (LADWP) used the Fairmont Reservoir No. 1 to regulate flows in the Los Angeles Aqueduct and to provide peaking power for downstream power plants. The LADWP abandoned the site after geologic studies following the 1971 Sylmar earthquake showed extensive instabilities, and no design for feasible repairs could be developed that would reduce damage to a safe level (CDWR 2004a). The Reservoir's seismic stability has not been evaluated since.

The abandoned site of Reservoir No. 1 is located approximately three miles south of Highway 138, 15 miles west of Lancaster, and two miles southwest of the proposed Buttes Reservoir as described above. As with Buttes Reservoir, the Fairmont site is 17.5 miles downstream of the existing Tehachapi Afterbay and one-third of a mile south of Check 46 (Myrick Siphon) on the California Aqueduct (see Figure 4-1). LADWP currently owns the site and operates a separate Fairmont Reservoir No. 2 as part of the LADWP water delivery system. The site does not currently connect to the State Water Project.

This potential alternative would involve reopening and reconfiguring the Fairmont Reservoir. As with the Buttes Reservoir, the Fairmont Reservoir would require enlargement of the Each Branch of the Aqueduct. As a result, this potential alternative was eliminated from further consideration. In addition, it is likely that the significant seismic safety issues that caused abandonment of Fairmont Reservoir could not be feasibly mitigated.

Mile 309 Offstream Storage

The Mile 309 Offstream Storage would be located between the Tehachapi Control Structure (at Cottonwood Chutes) and the Pearblossom Pumping Plant; five miles downstream from the existing Tehachapi Afterbay and east of Alamo Powerplant (see Figure 4-1). An 8,400-foot-long embankment with a maximum height of 26 feet and a crest elevation of 2,968 feet would form the reservoir. The reservoir would be immediately adjacent to the California Aqueduct and would have the same water surface elevation as the Aqueduct. This alternative would require modification of Alamo Powerplant and raising of the embankment along five miles of the East Branch of the California Aqueduct. This potential alternative was eliminated during the fatal flaw screening process due to the required enlargement of the East Branch of the Aqueduct. In addition, the Mile 309 Offstream Storage site is located in a large drainage that produces high sediment loads, where large spillway/diversion structures or expensive long-term maintenance would be required.

Multiple Reservoirs

The Multiple Reservoirs would be located south of the proposed project site, and south of the bifurcation of the California Aqueduct (see Figure 4-1). The Multiple Reservoirs would include a series of shallow earthen impoundments to store approximately 1,500 AF of water during off-peak periods. These impoundments would be constructed downstream of the existing Tehachapi Afterbay, providing for graduated storage rather than one large reservoir. The reservoirs would be bounded by the East Branch and low-lying hills to the southwest and

would be lined to prevent seepage losses. Due to the large watershed (approximately 30 square miles), a diversion or spillway would be required to prevent damage or overtopping of the low embankments.

During operation, water would flow from the existing Tehachapi Afterbay, over a sharp-crested weir and into the first impoundment. After filling the first impoundment, water would flow into each successive impoundment, over a spillway structure, into a collector trough, and through a trapezoidal connector channel. After the final impoundment, water would discharge into the East Branch below the Alamo Powerplant. Gates or valves would release the stored water into the East Branch during on-peak periods.

The shallow depth and high-surface area of the impoundments forming the multiple reservoirs would cause high levels of algae growth and evaporation during summer months requiring extensive monitoring and maintenance. Additionally, with this potential alternative, power recovery at Alamo Powerplant would not be possible, water would not be available for the West Branch, large diversion structures or extensive maintenance would be required to reduce impacts from sediment produced by the large watershed, and additional costs would be incurred to purchase private lands. As such, the Multiple Reservoirs would have substantial water quality, hydrologic and maintenance problems that would not be mitigated without a significant increase in construction and operational costs. Therefore, Multiple Reservoirs was eliminated from further consideration.

Tehachapi Afterbay Enlargement

The *Tehachapi Afterbay Enlargement Feasibility Study* (CDWR 2002) considered three potential alternatives to provide additional regulatory storage for the Valley String Pumping Plants consisting of 1,000-, 3,000-, and 6,000-AF reservoirs. The site for all three reservoirs is immediately south of where the existing Tehachapi Afterbay bifurcates to the East Branch and West Branch of the California Aqueduct, approximately nine miles east of Gorman, California (see Figure 4-1).

The 1,000-AF reservoir formed the basis for the Tehachapi Second Afterbay Alternative (see Section 4.3 below). The other two larger reservoirs (3,000- and 6,000-AF), while similar conceptually, are substantially different from the 1,000-AF reservoir in terms of size, area affected, required improvements, and scale of construction. Operative analyses determined the 3,000- and 6,000-AF reservoirs were larger than the total acre-feet needed to achieve the objectives as the proposed project.

Tehachapi Afterbay Enlargement – 3,000-AF

The 3,000-AF reservoir would provide a pool area of 210 acres, and would operate with a fluctuating reservoir elevation between 3,077 and 3,090 feet. At the normal maximum water surface elevation (3,090 feet), the 3,000-AF Alternative would have a gross storage capacity of approximately 2,950 AF. The minimum pool elevation (3,077 feet) would create 900 AF of dead storage above the reservoir invert. The operating storage capacity would be 2,050 AF. The dam would have a crest elevation of 3,100 feet, a crest length of approximately 4,000 feet, and a maximum height of approximately 44 feet above the natural slope.

Similar to the Tehachapi Second Afterbay Alternative or the 1,000-AF Alternative, the reservoir would be lower in elevation than Pool 42 and discharge to the East Branch either through the Alamo Powerplant or through a bypass. Flow to the West Branch would continue through Pool 42. The outlet would consist of a

gated concrete outlet tower and a 17-foot reinforced concrete pipe that would tie into the existing Alamo Penstock.

This potential alternative, like the Fairmont and Buttes Reservoirs, would affect a larger area than the proposed project, while meeting the same project objectives. Operative economics for this potential alternative show that it is oversized; therefore, it was eliminated from further consideration.

Tehachapi Afterbay Enlargement – 6,000-AF

The 6,000-AF reservoir would provide a pool area of 335 acres, and would operate with a fluctuating reservoir elevation between 3,096 and 3,102 feet. At the normal maximum water surface elevation (3,102 feet), the 6,000-AF reservoir would have a gross storage capacity of approximately 6,375 AF. The minimum pool elevation (3,096 feet) would create 4,375 AF of dead storage above the reservoir invert. The operating storage capacity would be 2,000 AF. The dam would have a crest elevation of 3,110 feet, a crest length of approximately 4,500 feet, and a maximum height of approximately 54 feet above the natural slope.

Pool 42 would incorporate the afterbay, allowing discharge into both the East and West Branches. The embankment of Pool 42 would house a gated inlet structure that would normally remain open in order to equalize the two reservoir elevations. Reservoir flow to the East Branch would occur either through the Alamo Penstock gates or through Cottonwood Chutes radial gates. The outlet would consist of a gated concrete outlet tower and two 12-foot reinforced concrete pipes that would tie into the existing Alamo Penstock.

This potential alternative, like the Fairmont and Buttes Reservoirs, would affect a much larger area than the proposed project, while meeting the same project objectives. Operative economics for this potential alternative show that it is oversized; therefore, it was eliminated from further consideration.

Subsequent Screening

After the initial fatal flaw screening, additional evaluation of alternatives was undertaken by the CDWR. During subsequent evaluation of the potential alternatives, the Quail Lake and TEA Over Land alternatives were eliminated from further consideration for reasons described in the discussions of each alternative below. Those alternatives determined to be both reasonable and feasible (i.e., without fatal flaws) are discussed in Section 4.3.

Quail Lake

The CDWR evaluated the Quail Lake Alternative as part of the Valley String Peaking Storage Study and eliminated it based on the environmental issues described below. To use Quail Lake as alternative storage for the East Branch would require modification of the West Branch of the State Water Project between Oso Pumping Plant and Lower Quail Canal, thereby allowing reversible flow from Quail Lake to meet East Branch delivery requirements during periods of high power demand. Currently, Quail Lake experiences fluctuations in lake level because it is used as storage for the West Branch. For this potential alternative, both the East and West Branches would utilize Quail Lake's capacity as storage. For East Branch deliveries, water stored in Quail Lake would be pumped back into Upper Quail Canal, would flow back through converted pump/turbine units at Oso Pumping Plant, and into the existing Tehachapi Afterbay (see Figure 4-2). Initial analysis indicates that peaking storage could utilize up to 6,000 AF of Quail Lake, which accounts for nearly the entire

volume of the lake. As such, utilizing Quail Lake for East Branch storage would substantially increase the daily fluctuation in the surface level of the lake. A cycle of constant drying and inundation would be expected to result in a substantial reduction of freshwater marsh and southern willow scrub. Avian species using the freshwater marsh for cover and nesting would potentially suffer higher levels of predation and reduced nesting success. In addition, sensitive amphibian and reptile species that may use the site would also be affected by changes in water levels, temperature, and moisture levels in shoreline sediments. This impact to biological resources at Quail Lake would be significant.

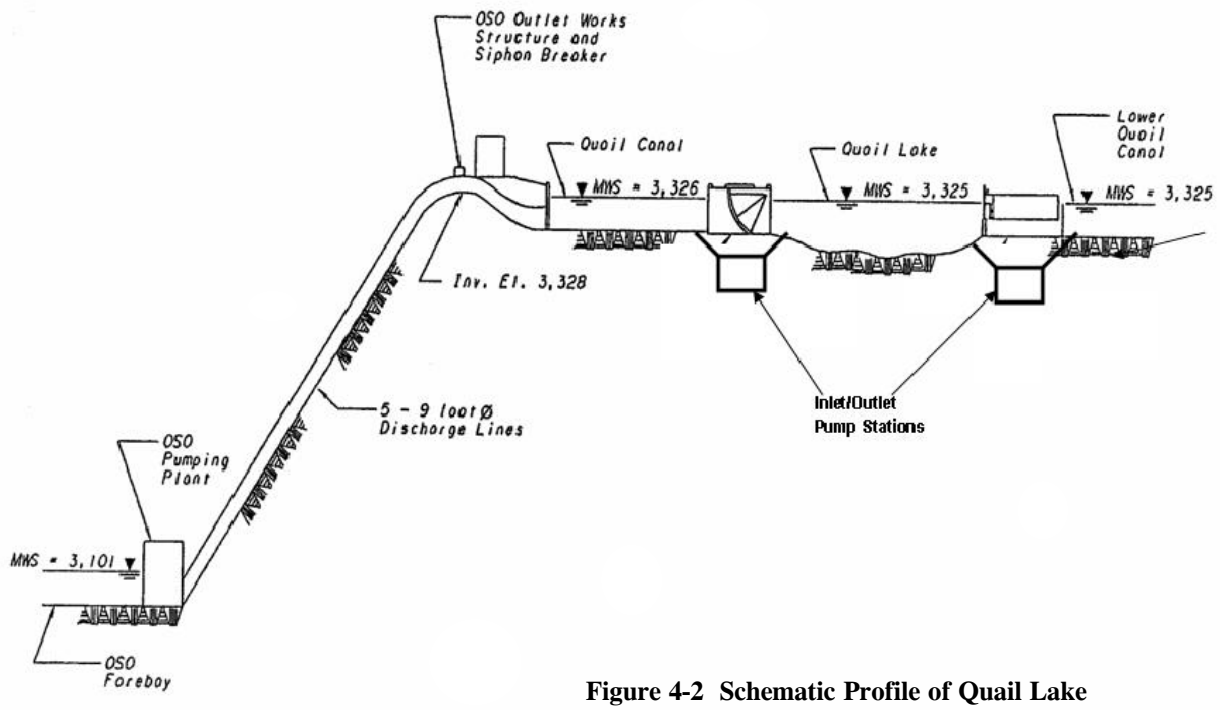


Figure 4-2 Schematic Profile of Quail Lake

In addition to biological impacts, using Quail Lake for East Branch deliveries would result in significant impacts to recreation and visual resources that would not be experienced with the proposed project. Because of the substantial weekly drawdowns of water in the lake associated with this alternative, the current recreational uses of the lake would be adversely affected, including the popular fishing, picnicking, and wildlife viewing opportunities afforded by the lake. The drawdowns of water required for operation of this alternative could eliminate the Quail Lake fishery and its use as a resource for recreational fishing. The drawdowns would also make the lake a much less desirable location for picnicking and wildlife viewing. In addition, the weekly lowering of the water level would detract from the visual quality of the area by reducing the size of the lake and exposing more of the lake shoreline and bottom. The recreational and aesthetic impacts associated with the Quail Lake drawdowns would be significant.

Finally, this potential alternative is much more operationally complex than the proposed project. Operation of Quail Lake for East Branch deliveries would require pumping of water in Quail Lake into Upper Quail Canal, thereby allowing the water to flow back through converted pump/turbine units at Oso Pumping Plant and into the existing Tehachapi Afterbay. The operational aspects of this potential alternative not only contribute to the

recreation and aesthetic impacts described above, but also prevent it from fulfilling the project objectives as well as the proposed project. Therefore, this potential alternative was eliminated from further consideration.

TEA Over Land

Following the relocation of the project from the T2A site to northeast of the aqueduct, new reservoir configurations and designs were explored to facilitate the decision to proceed with the proposed project, as it is described in Section 2 – Project Description. New designs were considered to avoid and reduce permanent alterations to the unnamed drainage and impacts to existing wildlife living within it. These potential alternatives are referred to as the TEA Alternatives, and the Enlarged Afterbay Alternative (see Section 4.3 – Analysis of Reasonable Alternatives). TEA Over Land was eliminated from further consideration based on the environmental considerations discussed below.

The TEA Over Land potential alternative would be similar to the proposed project, except in the manner in which the existing natural drainage channel would be crossed. TEA Over Land would divert the water from the existing Tehachapi Afterbay (Pool 42) through an inlet channel, just west of the drainage channel. Water would flow north, then east across the northernmost portion of the drainage channel, and then return south into the proposed reservoir. Impacts to the drainage channel would occur within an area occupied by burrowing owl. Owl pellets, potentially suitable burrows, and scat were found in the area approximately 900 feet north of the proposed project site. The presence of burrowing owl in the proposed TEA project area cannot be excluded, although similar evidence was not found in this area. Perhaps the relatively greater availability of surface water, prey, and mammal burrows makes the area north of the proposed project area that would be affected by the TEA Over Land alternative more suitable to the species. As such, biological impacts for TEA Over Land would be greater than the proposed project, without improving the ability to meet the project objectives. In addition, the total land area permanently impacted by the TEA Over Land alternative would be much greater than the proposed project. No project impacts would be reduced or avoided by TEA Over Land. Therefore, this potential alternative was eliminated from further consideration.

Tehachapi Afterbay Enlargement – 1,000-AF

The 1,000-AF reservoir would provide a pool area of 56 acres, and would operate with a fluctuating reservoir elevation between 3,070 and 3,090 feet. At the normal maximum water surface elevation (3,090 feet), the 1,000-AF reservoir would have a gross storage capacity of approximately 1,370 AF. The minimum pool elevation (3,070 feet) would create 350 AF of dead storage above the reservoir invert. The operating storage capacity would be 1,020 AF. The dam would have a crest elevation of 3,096 feet, a crest length of approximately 4,192 feet, and a maximum height of approximately 46 feet above the natural slope.

A combination of cut and impoundment would form the reservoir. Material from the excavation of the reservoir would form the embankment surrounding the reservoir. An uncontrolled open channel spillway would be located in the west abutment. The inlet would consist of an uncontrolled concrete weir and chute that would discharge from Pool 42.

Because the proposed reservoir would be lower in elevation than Pool 42, reservoir discharges would be made to the East Branch either through the Alamo Powerplant or through a bypass. Flow to the West Branch would

continue through Pool 42. The outlet would consist of a gated concrete outlet tower and a 17-foot diameter, reinforced concrete pipe that ties into the existing Alamo Penstock.

To provide access to the weir and return access down the existing aqueduct road, a pair of railcar bridges would be constructed over the inlet channel.

Unlike the 3,000- and 6,000-AF reservoirs, which were oversized, the 1,000-AF reservoir would meet the project objectives without affecting a large surface area. As such, all subsequent reservoir designs evolved from the concept of a 1,000-AF reservoir sited along the East Branch of the Aqueduct between the bifurcation and Alamo Powerplant. Therefore, the potential 1,000-AF Tehachapi Afterbay Enlargement alternative developed into the reasonable alternatives discussed below.

4.3 Analysis of Reasonable Alternatives

According to Section 15126.6(f)(1) of the State CEQA Guidelines, the factors that may be taken into account when addressing the feasibility of reasonable alternatives include site suitability, economic viability, availability of infrastructure, general plan consistency, other plans or regulatory limitations, jurisdictional boundaries, and whether the proponent can reasonably acquire, control, or otherwise have access to the alternative site.

The first step in the CEQA alternative analysis process involved the identification of a broad range of reasonable alternatives. The reasonable alternatives were then evaluated based on the following criteria:

- Potential for substantially reducing significant impacts compared to the proposed project;
- Consistency with the CDWR's project objectives; and
- Feasibility.

After evaluating the potential alternatives (see Section 4.2 above), the CDWR decided to study the 1,000-AF Tehachapi Afterbay Enlargement option in greater depth, and developed the T2A project (T2A Alternative). A Notice of Preparation and an Initial Study were completed for the T2A project; however, based on more detailed engineering design investigations, costs associated with project construction escalated and the CDWR decided to redesign the T2A project and move it to a new location northeast of the East Branch, which is the site of the proposed project.

As discussed in Section 4.2 above, following the relocation of the project site, new reservoir configurations and designs were explored to facilitate the decision to proceed with the proposed project. Four distinct alternatives were developed and have been analyzed as CEQA alternatives. These alternatives focus on avoiding and reducing permanent alterations to the unnamed drainage and impacts to existing wildlife living within it. These alternatives include different methods to cross the existing drainage channel or completely avoid the channel.

The suitability of the reasonable alternatives for full analysis in this EIR was determined based on the CEQA alternative analysis process. The T2A Alternative, TEA Jacking/Tunneling Alternative, TEA Trenching Alternative, TEA Overchute Alternative, and the Enlarged Afterbay Alternative were considered suitable for evaluation in the EIR due to their ability to meet the basic project objectives and potential to result in fewer significant environmental impacts than the proposed project. All of these alternatives are considered feasible to

construct and operate. The potential environmental effects for these alternatives, as well as the No Project Alternative, compared to the proposed project are presented below.

4.3.1 Tehachapi Second Afterbay (T2A)

The T2A Alternative would be located southwest of the proposed project site, west of Cottonwood Chutes as shown in Figure 4-3. Flow to the East Branch, which currently is routed through the existing Tehachapi Afterbay (Pool 42) to Cottonwood Chutes or Alamo Powerplant, would diverge from Pool 42 into the T2A via an inlet chute and discharge below Cottonwood Chutes. As a result of the T2A Alternative, flow to the West Branch would remain relatively unchanged, although a small amount of additional storage (approximately 120 AF) would be available for off-peak operations at Oso Pumping Plant.

The T2A Alternative would include a reservoir (afterbay) with a gross storage capacity of 1,196 AF and would inundate approximately 64 acres. The afterbay would be designed to operate with a 25-foot fluctuating reservoir elevation between 3,100 and 3,075 feet. The minimum pool elevation (3,075 feet) would create 269 AF of unusable or dead storage above the reservoir invert (elevation 3,066 feet). This nine-foot pool below the minimum operating elevation would be used to decrease the velocity of the inflow as it enters the afterbay, provide for sediment storage, provide a slope over the afterbay invert, and improve water quality if the afterbay were to be operated at lower elevations for extended periods of time. The active storage capacity would be 927 AF. The dam would have a crest elevation of 3,107 feet, a crest length of approximately 4,300 feet, and a maximum height of approximately 47 feet above the original ground level.

The interior of the reservoir would be lined with compacted soil, permeable asphalt concrete (PAC), and hydraulic asphalt concrete (HAC). Approximately 197,000 CY of compacted soil from the afterbay site (i.e., reservoir excavation material) would be required to form a three-foot thick compacted soil liner. Alternatively, the reservoir may be lined with clay material to reduce reservoir leakage and the potential for liquefaction. If it is determined that a clay liner is necessary, the clay material would be excavated from a borrow site located south of the proposed afterbay site, as shown in Figure 4-3. Additional material would be available from the reserve clay liner borrow site; however, this material is not as favorable (i.e., contains less clay material) and would be used only on an as-needed basis.

The inlet to the afterbay would consist of a weir and a concrete-lined chute, designed for an inlet flow of 3,149 cubic feet per second (cfs) that would discharge from the existing Tehachapi Afterbay. Access along the existing Aqueduct would occur by crossing over the new inlet structure when water levels are manageable for maintenance vehicles.

The reservoir would discharge 2,000 cfs to the East Branch through an outlet tower and 12-foot diameter steel pipeline. The outlet pipeline would pass through the reservoir foundation and discharge below Cottonwood Chutes, a length of approximately 400 feet. A blow-off valve would be located in the new 12-foot diameter pipeline to provide added operational flexibility. This valve would be operated using an electric/hydraulic system. A 12-foot diameter stub would also be provided near the outlet structure to allow for future tie-in to the existing Alamo Penstock.

Construction of the T2A Alternative would temporarily impact approximately 101 acres and permanently impact approximately 80 acres. The reservoir pool would be constructed by a combination of cut and impoundment. Over three million CY of existing material at the reservoir site would be removed (cut) and replaced (impounded) to form a strengthened foundation and reservoir embankment. The foundation beneath the embankment would be excavated approximately 65 feet below original ground to reach the approximate elevation of underlying terrace (Qt) deposits. Based on a 65-foot foundation depth, additional material(100,000 to 400,000 CY) may be needed, which would be found approximately 1,000 feet west of the proposed reservoir in the auxiliary borrow area as shown in Figure 4-3. Alternatively, extra material may not be needed and, in fact, excess material may need to be disposed in the spoil area. In general, embankments would be composed of soils from required excavations. As with the proposed project, none of the excavated material would be hauled off-site.

Air Quality

Similar to the proposed project, construction of the T2A Alternative would result in impacts to air quality from earth movement (creating fugitive dust) and exhaust emissions from construction equipment and haul truck trips. Construction of the reservoir would involve the excavation of over three million CY of material, whereas the proposed project would require approximately 3.2 million CY of excavation. Since earth movement is the single largest source of fugitive dust generation, the T2A Alternative would have the potential to result in similar, but fewer air pollutant emissions, specifically PM_{10}, than the proposed project. Given that the proposed project considerably exceeds two air quality standards, namely NO_x and PM_{10}, the air pollutant emissions from the T2A Alternative would also be significant.

Biological Resources

Vegetation within the T2A site is primarily disturbed plant associations including weed-dominated flats with rabbitbrush scrubs located throughout most of the site and scrub vegetation with sparse cottonwood (*Populus fremontii*), mulefat (*Baccharis salicifolia*) and scalebroom (*Lepidospartum squamatum*) located within the wash channel and side drainages. An abandoned orchard and some trees that were planted in rows by the California Department of Fish and Game (CDFG) are located within the site of the proposed reservoir. The understory and interspaces between plantings are weedy, but not ruderal.

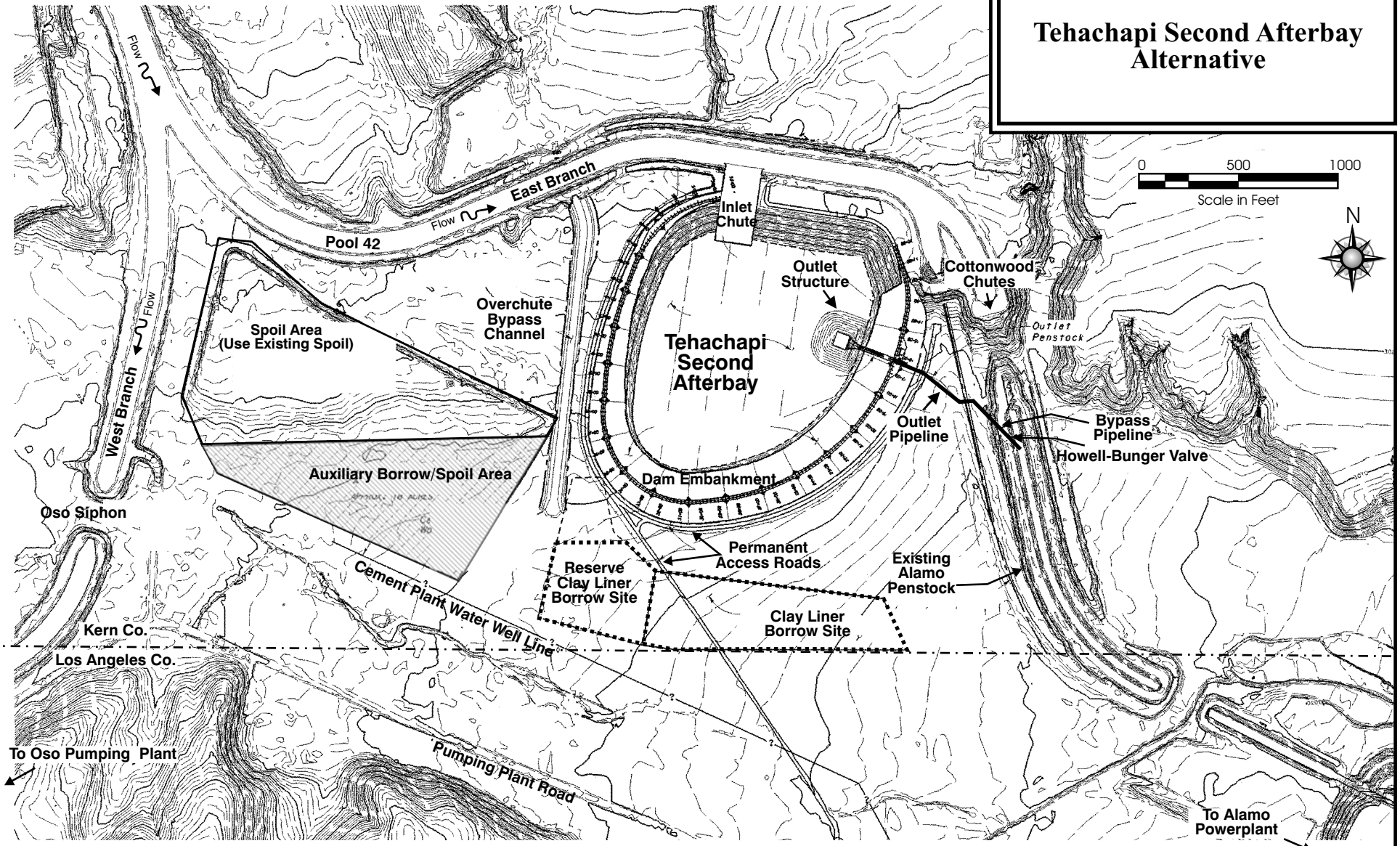
Because of its proximity to the aqueduct and riparian vegetation along the drainages, a variety of bird species were observed within or near the project area including American kestrel (*Falco sparverius*), great blue heron (*Ardea herodias*), California quail (*Callipepla californica*), and rock wren (*Salpinctes obsoletus*). A few mammals and reptiles were observed (although in this habitat they are less apparent and many are less active during the day), which include the California ground squirrel (*Spermophilus beecheyi nudipes*), coyote (*Canis latrans clepticus*), western fence lizard (*Sceloporus occidentalis*), and side-blotched lizard (*Uta stansburiana*).

Several special status plant and animal species may occur near the project area, but none of these were observed within the project area primarily because the site has been chronically disturbed by grazing and farming as well as by previous construction of the aqueduct. Soils are generally not suitable for burrowing mammals or reptiles, and there would be no aquatic or wetland habitat to support special status species within or near the T2A footprint.

Tehachapi East Afterbay Project

Figure 4-3

Tehachapi Second Afterbay Alternative



The T2A alternative would have the potential to permanently impact a total of approximately 80 acres of primarily rabbitbrush scrub, whereas the proposed project would permanently impact up to 215.5 acres. The proposed project site is also more isolated than the T2A site, with somewhat sandier soils, and habitat more suitable for burrowing species, including the burrowing owl, which occurs near the project area. Both the T2A and proposed project sites would require a Streambed Alteration Agreement (SAA) for impacting drainages under CDFG jurisdiction. However, the nature and magnitude of the drainage impacts are different. The T2A Alternative would require channelizing a portion of the surface drainage from Little Sycamore Creek for approximately 1,700 feet around the reservoir into Oso Creek, but the surface drainage in this area has already been altered by the existing aqueduct. The T2A Alternative would also require improvements to an existing access road that would permanently affect approximately 840 square feet of the Creek. Conversely, the proposed project would affect approximately 4,400 feet of the unnamed drainage with temporary construction areas and permanent facilities. In conclusion, the T2A Alternative would result in biological impacts that are similar in nature to, but lesser in magnitude than the proposed project.

Other Potential Issues

Other potential issues associated with the T2A Alternative include safety, constructability, and operations. The T2A Alternative would include a reservoir impounded by a dam, which is generally considered to pose a higher risk of failure than an excavated reservoir. As such, the T2A Alternative would fall under Division of Safety of Dams jurisdiction. Constructability is also a valid issue when considering the feasibility of an alternative project. Unlike the proposed project, which would involve temporary disruptions to downstream water deliveries (CDWR 2004d), the T2A Alternative would not require substantial disruption of East Branch water deliveries. While the outage requirements of the proposed project are practical, there are unavoidable risks that would be undertaken for the short term that are of lesser consequence for the T2A Alternative, where fewer alterations to the existing Pool 42 and Headworks would be required.

Operation of the T2A Alternative would be expected to be more complex than the proposed project, which can be operated similar to a wide spot in Pool 42. The T2A Alternative would likely require operation of the penstock slide gates to maintain maximum head at the Alamo Powerplant, whereas the proposed project would require few changes to the headworks and pool elevations would remain the same. Additionally, the T2A Alternative would require installation of a new penstock to connect to Alamo Powerplant, whereas the proposed project would allow uninterrupted operation of Alamo Powerplant (except during a short period during construction). Furthermore, prior to construction of the penstock connection, the T2A reservoir would discharge into Cottonwood Chutes via an energy dissipater valve (EDV). This would add additional operational complexity not inherent in the operation of the proposed project.

4.3.2 TEA Jacking/Tunneling Alternative

The TEA Jacking/Tunneling Alternative would be similar to the proposed project, except in the manner in which the inlet and outlet structures would cross the existing drainage channel. The TEA Jacking/Tunneling Alternative would install pipe under the drainage channel using a jacking or tunneling method. Although the installation of pipelines using the jacking or tunneling technique avoids the continuous surface disruption common to open-trench construction (trenching), some surface disruption is unavoidable because a pit (jacking

and receiving pits or access shafts) would be required on either side of the drainage channel. These pits would be placed a reasonable distance from the drainage channel to avoid impacts to the channel. Pipeline would then be installed under the drainage channel. As such, no impacts would occur on the topographic contours of the drainage channel.

Air Quality

Similar to the proposed project, construction of the TEA Jacking/Tunneling Alternative would result in impacts to air quality from earth movement (creating fugitive dust), and exhaust emissions from construction equipment and haul truck trips. Construction of the reservoir would involve similar excavation quantities and would, therefore, result in similar air quality impacts as the proposed project. Given that the proposed project considerably exceeds two air quality standards, namely NO_x and PM_{10}, the air pollutant emissions from construction of the TEA Jacking/Tunneling Alternative would also be significant.

Biological Resources

Impacts to biological resources for the TEA Jacking/Tunneling Alternative would be similar to the proposed project, as generally the same area to the northeast of Cottonwood Chutes would be impacted. However, unlike the proposed project, the inlet and outlet structures would consist of pipelines that would cross below the existing natural drainage channel, thereby avoiding impacts to this feature. However, while a SAA would still be needed for this alternative, the nature of the impacts would be different than the proposed project. The habitat at the bottom of this drainage does not support any special status plant species, but it is protected from the adjacent uplands and not subject to the same temperatures or windy arid conditions so it does provide a different set of habitat conditions for wildlife. The below grade structures required for this alternative may impede subsurface hydrology in the drainage, which may in turn adversely affect vegetation in the channel. It is important to recognize that even though the land disturbance for the placement of underground structures is avoided, changes to subsurface hydrology and vegetation supported by it in this arid environment are, in a practical sense, permanent. Although this alternative would also result in long-term impacts to wildlife habitat, they would still be relatively less when compared to the option of aboveground structures.

Other Potential Issues

Other potential issues associated with the TEA Jacking/Tunneling Alternative include safety, constructability, and operations. This alternative would include an excavated reservoir, similar to the proposed project, but would include underground pipelines beneath the existing drainage channel rather than large inlet and outlet structures that traverse channel. These pipes would be designed to an equivalent level of safety as the proposed project's inlet and outlet structures. Therefore, the safety issues surrounding the TEA Jacking/Tunneling Alternative would be comparable to the proposed project.

Construction of the TEA Jacking/Tunneling Alternative would be similar to the proposed project, except for the inlet and outlet structures. Construction of the underground pipelines would require jacking and receiving pits or access shafts on either side of the drainage channel. These pits would be placed a reasonable distance from the existing drainage channel to avoid impacts to the channel. It is expected that installation of the inlet and outlet pipelines using the jacking or tunneling method would require more excavation than the inlet and outlet structures crossing the drainage channel as part of the proposed project. Similar to the proposed project,

the TEA Jacking/Tunneling Alternative would require substantial disruption of East Branch water deliveries during construction.

Operations of the TEA Jacking/Tunneling Alternative would be similar to the proposed project.

4.3.3 TEA Trenching Alternative

The TEA Trenching Alternative would be similar to the proposed project, except in the manner in which the existing drainage channel would be crossed. Unlike the proposed project, which would include permanent impacts to the channel from the installation of inlet and outlet structures, the TEA Trenching Alternative would install pipe in the drainage channel through a trenching process. Trenching requires excavation of the drainage channel and replacement of soil, thereby causing temporary impacts to the drainage channel during construction. However, unlike the jacking and tunneling techniques, jacking and receiving pits or access shafts would not be required.

Air Quality

Similar to the proposed project, construction of the TEA Trenching Alternative would result in impacts to air quality from earth movement (creating fugitive dust), and exhaust emissions from construction equipment and haul truck trips. Construction of the reservoir would involve similar excavation quantities and would, therefore, result in similar air quality impacts as the proposed project. Given that the proposed project considerably exceeds two air quality standards, namely NO_x and PM_{10}, the air pollutant emissions from construction of the TEA Trenching Alternative would also be significant.

Biological Resources

Impacts to biological resources for the TEA Trenching Alternative would be similar to the proposed project, as generally the same area to the northeast of Cottonwood Chutes would be impacted. However, unlike the proposed project, the inlet and outlet structures would consist of pipelines that would cross below the natural drainage channel, thereby avoiding permanent impacts to this feature. A SAA would be needed for this alternative for trenching activities within the drainage channel. Additionally, the below grade structures required for this alternative may impede subsurface hydrology in the drainage, which may in turn adversely affect vegetation or make it more difficult to restore vegetation following construction. It is important to recognize that even though the land disturbance for the placement of underground structures is considered temporary, changes to subsurface hydrology and vegetation in this arid environment are, in a practical sense, permanent. Although this alternative would also result in long-term impacts to wildlife habitat, they would still be relatively less when compared to the option of aboveground structures

Other Potential Issues

Other potential issues associated with the TEA Trenching Alternative include safety, constructability, and operations. This alternative would include an excavated reservoir, similar to the proposed project, but would include underground pipelines under the existing drainage channel rather than large inlet and outlet structures that traverse channel. These pipes would be designed to an equivalent level of safety as the proposed project's inlet and outlet structures. Therefore, the safety issues surrounding the TEA Trenching Alternative would be comparable to the proposed project.

Construction of the TEA Trenching Alternative would be similar to the proposed project, except for the inlet and outlet structures. It is expected that installation of the inlet and outlet pipelines by trenching would require less extensive construction compared to the large concrete inlet and outlet structures crossing the drainage channel as part of the proposed project. Similar to the proposed project, the TEA Trenching Alternative would require substantial disruption of East Branch water deliveries during construction.

Operations of the TEA Trenching Alternative would be similar to the proposed project.

4.3.4 TEA Overchute Alternative

The TEA Overchute Alternative would be similar to the proposed project, except in the manner in which the inlet and outlet structures would be constructed across the existing drainage channel. Unlike the proposed project, which would include permanent impacts to the channel from the installation of a large culvert, the TEA Overchute Alternative would involve construction of an overchute, or bridge-like structure, across the drainage channel, resulting in limited impacts to the drainage channel.

Air Quality

Similar to the proposed project, construction of the TEA Overchute Alternative would result in impacts to air quality from earth movement (creating fugitive dust), and exhaust emissions from construction equipment and haul truck trips. Construction of the reservoir and inlet and outlet structures would involve similar excavation quantities and haul truck trips and would, therefore, result in similar air quality impacts as the proposed project. Given that the proposed project considerably exceeds two air quality standards, namely NO_x and PM_{10}, the air pollutant emissions from construction of the TEA Overchute Alternative would also be significant.

Biological Resources

Impacts to biological resources for the TEA Overchute Alternative would be similar to the proposed project, as generally the same area to the northeast of Cottonwood Chutes would be affected. However, unlike the proposed project, the inlet and outlet structures would bridge the natural drainage, thereby substantially reducing permanent impacts to the existing drainage channel. For this alternative, there would still be potential disturbance to burrowing owl habitat where the "bridge" extends to the banks of the drainage or where a mid-span pier would be located. This alternative would also require a SAA, but the surface disturbance would be somewhat less than the proposed project.

Other Potential Issues

Other potential issues associated with the TEA Overchute Alternative include safety, constructability, and operations. This alternative would include an excavated reservoir, similar to the proposed project, but the open channel inlet and outlet crossings that would span the existing drainage would be supported by bridge structures rather than embankment. These bridges would be designed to an equivalent level of safety as the proposed project's inlet and outlet structures. Therefore, the safety issues surrounding the TEA Overchute Alternative would be comparable to the proposed project. Similar to the proposed project, the TEA Overchute Alternative would require substantial disruption of East Branch water deliveries during construction.

Operations of the TEA Overchute Alternative would be similar to the proposed project.

4.3.5 Enlarged Afterbay Alternative

The Enlarged Afterbay Alternative would relocate the reservoir north of the East Branch and west of the existing drainage channel, thereby resulting in no direct impacts to the drainage channel.

Air Quality

Similar to the proposed project, construction of the Enlarged Afterbay Alternative would result in impacts to air quality from earth movement (creating fugitive dust), and exhaust emissions from construction equipment and haul truck trips. Construction of the reservoir would involve a substantially larger excavation volume to form the reservoir than the proposed project and would, therefore, result in greater air quality impacts than the proposed project. Given that the proposed project considerably exceeds two air quality standards, namely NO_x and PM_{10}, the air pollutant emissions from construction of the Enlarged Afterbay Alternative would also be significant.

Biological Resources

The Enlarged Afterbay Alternative is located in an area with habitat characteristics similar to the area that will be occupied by the TEA reservoir, spoil area, and the construction laydown areas (i.e., upland terrace and alluvial plain), with the exception that this alternative would avoid the unnamed drainage. Habitat resources are more varied and abundant in this natural drainage channel relative to the upland areas, which is why there is relatively more wildlife activity recorded in this area, including the burrowing owl and coast horned lizard. Because the Enlarged Afterbay Alternative would avoid this drainage, this alternative would result in relatively less impact than the proposed project to the coast horned lizard, which is more likely to occupy the alluvial soils of the unnamed drainage rather than the upland areas.

Other Potential Issues

Other potential issues associated with the Enlarged Afterbay Alternative include safety, constructability, and operations. This alternative would include an excavated reservoir, similar to the proposed project, but would not include complex inlet and outlet structures. However, construction would be complicated due to the substantially larger excavation volume required to form the reservoir. Similar to the proposed project, the Enlarged Afterbay Alternative would require substantial disruption of East Branch water deliveries during construction.

Operational activities associated with the Enlarged Afterbay Alternative may be more complicated than the proposed project as additional diversions gates would be required. Furthermore, a complicated baffle system would be required to ensure adequate reservoir circulation.

4.3.6 No Project Alternative

The No Project Alternative would involve no construction related to a new afterbay facility and current operations would be maintained. Therefore, the No Project Alternative would result in no new environmental impacts. While the No Project Alternative would avoid all significant and less-than-significant impacts

associated with the proposed project, it would allow none of the proposed project's benefits. By shifting pumping load to periods of lower demand, the proposed project would benefit all of California by helping to stabilize the statewide energy load. The No Project Alternative would eliminate this statewide benefit, and could contribute to the need for future power generation projects and less efficient use of existing power generation facilities.

4.4 Environmentally Superior Alternative

Air Quality

Construction of the proposed project with incorporation of the proposed air quality mitigation measures would generate quantities of NO_x and PM_{10} that exceed emission thresholds for these pollutants and expose sensitive receptors to substantial pollutant concentrations. Except for the No Project Alternative, construction of each reasonable alternative with incorporation of similar mitigation measures would cause the same types of impacts as the proposed project. The quantities of each pollutant would differ for each alternative, but cannot be quantitatively ascertained without considerable development of design and construction details. However, it is known that the total emissions of NO_x and PM_{10} associated with the construction of the T2A alternative would be less, but of a similar order of magnitude as the proposed project. Hence, none of the reasonable alternatives, except the No Project Alternative, would substantially reduce impacts to air quality. While the No Project Alternative would not generate impacts to air quality, it would not meet the objectives of the proposed project.

Wildlife and Wildlife Habitat in the Unnamed Drainage

Construction of the proposed project with incorporated mitigation measures may affect reptile and bird species or their habitat that are State and/or Federal species of concern and birds protected under the Migratory Bird Treaty Act and the California Fish and Game Code. In addition, impacts to habitat within the unnamed drainage would be permanent as would be alterations to the drainage. With the exception of impacts to the coast horned lizard these impacts are characterized as Class II impacts, significant but mitigated to less-than-significant.

Impacts to the coast horned lizard that would result from the proposed project are deemed Class I, significant and unavoidable, because a loss of lizards and their habitat would occur. Although the extent and magnitude of this loss remains unknown until focused surveys are completed prior to construction, the continued existence of the species would not be endangered or threatened. Though feasible mitigation measures that continue to meet the objectives of the proposed project would be implemented, it is likely they would not adequately address the loss.

Each reasonable alternative avoids permanent impacts to wildlife habitat in the unnamed drainage. However, temporary impacts from the TEA Jacking/Tunneling Alternative, TEA Trenching Alternative, and TEA Overchute Alternative would generate significant though temporary impacts to wildlife habitat and the unnamed drainage due to the need to conduct some construction activity within the drainage. Like the proposed project these impacts would be mitigated to less-than-significant levels with the exception of impacts to the coast horned lizard, which would be similar in nature to the proposed project. The No Project Alternative, the

T2A Alternative, and the Enlarged Afterbay Alternative would all avoid permanent and temporary impacts to the unnamed drainage, wildlife habitat and movement corridor within the drainage and impacts to the coast horned lizard, in particular.

The proposed project would permanently impact up to 215.5 acres of open space while the T2A Alternative would permanently impact 80 acres, and the No Project Alternative would impact zero acres. Permanent impacts to open space caused by the other reasonable alternatives are not quantifiable without considerable development of design and construction details. Regardless of the quantity, permanent impacts to open space are mitigated to less that significant through purchase at a minimum ratio of 1.1:1 of land of similar quality habitat and establishment of a conservation easement on the land.

Environmentally Superior Alternative

All reasonable alternatives, except the No Project Alternative, are unlikely to substantially reduce or avoid the impacts to air quality. Three alternatives (No Project Alternative, T2A Alternative, and Enlarged Afterbay Alternative) would avoid the specific impacts to the unnamed drainage and wildlife and habitat within it, but two of these alternatives would likely affect similar resources in similar yet distinctive ways. Therefore, the No Project Alternative is environmentally superior because it would avoid all of the adverse impacts associated with both project construction and operation and would not generate unique environmental impacts. However, the No Project Alternative would not generate the various benefits or meet the three objectives of the proposed project. When the No Project Alternative is excluded from consideration, it is apparent that the T2A Alternative would be the environmentally superior alternative since it would have similar yet slightly reduced air quality impacts, and avoid impacts to the drainage and wildlife and habitat within it. The drawbacks to the T2A Alternative include more complex operations, and the need for a future installation of a penstock connection to Alamo Powerplant to meet the same operational flexibility of the proposed project.

Table 4-1 provides a summary comparing the impacts of the proposed project to the alternatives, including operations and maintenance considerations.

Table 4-1. Comparison of Alternatives to the Proposed Project

Topic	Proposed Project	T2A	TEA Jacking/ Tunneling	TEA Trenching	TEA Overchute	Enlarged Afterbay	No Project
Air Quality Impacts	Significant short-term construction impacts to local air quality conditions.	= Similar to Proposed Project	= Similar to Proposed Project	= Similar to Proposed Project	= Similar to Proposed Project	> Greater than Proposed Project	No impact
Biological Resource Impacts	Possible adverse effects on the unnamed drainage and wildlife and habitat within it.	No impact	< Less than Proposed Project	< Less than Proposed Project	< Less than Proposed Project	No impact	No impact
Biological Resource Impacts	Possible adverse effects on sensitive or special-status species. Adverse effect on waters of the State.	= Similar to Proposed Project	< Less than Proposed Project	< Less than Proposed Project	< Less than Proposed Project	= Similar to Proposed Project	No impact
Operational Complexity	Operation similar to operating a wide spot in Pool 42. No on-site operational personnel required.	> Greater than Proposed Project	= Similar to Proposed Project	= Similar to Proposed Project	= Similar to Proposed Project	> Greater than Proposed Project	No change
East Branch Outage	There would be substantial temporary disruptions to East Branch water deliveries during construction.	< Less than Proposed Project	= Similar to Proposed Project	= Similar to Proposed Project	= Similar to Proposed Project	= Similar to Proposed Project	No change